United Nations Environment Programme

Distr.
LIMITED

UNEP/WG.7/26
7 March 1977

Original: ENGLISH

UNEP Meeting of experts designated by Governments, Intergovernmental and Non-Governmental Organizations on the Ozone Layer

Washington, D.C., 1-9 March 1977

AUSTRALIAN POSITION PAPER OUTLINING CURRENT MONITORING AND RESEARCH BEING CARRIED OUT INTO STRATOSPHERIC OZONE AND RELATED SUBJECTS

Submitted by

The Government of Australia

This paper summarises the present Australian program of monitoring and research into stratospheric ozone, and associated studies into the manufacture and use of fluorocarbons. It is divided into the following sections:

1. A review of the activities of the Australian Bureau of Meteorology to study the thermal structure and circulation of the stratosphere.

2. A review of the research currently being carried out by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) into stratospheric ozone, related gaseous pollutants, particulates and ultra violet radiation.

3. Studies into the Australian production and usage of fluorocarbon materials being carried out by the Department of Environment, Housing and Community Development.

1. AUSTRALIAN BUREAU OF METEOROLOGY

The Australian Bureau of Meteorology has, for the past twenty years, been making routine extended upper air balloon flights to monitor the thermal structure and circulation of the stratosphere. The network of 16 stations for which data is available on a daily basis up to December 1976 is shown in the attached figure. A recent change to smaller balloons will mean that the pressure level reached by 50 per cent of flights will be lowered from 12 mb to 54 mb (30 km to 20 km) approximately. It is proposed, however, that the higher altitude flights will continue indefinitely at Darwin, Alice Springs and Laverton to maintain the climatological record of stratospheric wind and temperature over a range of latitude.

From October 1970 to December 1973, the Bureau of Meteorology carried out a program of rocket probes into the stratosphere from Woomera up to a height of about seventy kilometres to determine the seasonal variation of stratospheric wind patterns. There are no plans to reactivate this program.

The Bureau of Meteorology also operates a total ozone measurement program in Brisbane and Hobart on behalf of the CSIRO Division of Atmospheric Physics.

During the last decade, stratospheric research in the Bureau of Meteorology has been concerned with a diagnostic study of the behaviour of the Southern Hemisphere polar vortex and stratospheric circulation up to thirty millibars (about 23 km) in relation to the Spring time warming. Research has also been undertaken into the synoptic climatology of winds in the stratosphere with particular emphasis on the transport of radioactive debris.

The attached map shows the network of radiosonde stations in Australia at which 50 per cent of balloon flights attain an altitude of approximately 30 km (12 mb). Daily observations available for approximately twenty years to December 1976. The high altitude stations at Mawson, Cabey and Macquarie Island were also a part of this network. Program to continue indefinitely.

2. COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION

Two Divisions of CSIRO are conducting research into factors that may affect the ozone layer. The Division of Atmospheric Physics based at Aspendale near Melbourne, Victoria is monitoring ozone concentrations, gaseous pollutants and the incidence of ultra-violet radiation. The Division of Cloud Physics is interested in particles found in both the atmosphere and the stratosphere and has developed methods for collection and analysis.

Division of Atmospheric Physics
Atmospheric Chemistry Program

OZONE

Atmospheric ozone has been monitored for almost 20 years. Six monitoring stations have been established in Australia and they are located at Aspendale (near Melbourne), Cairns, Brisbane, Perth, Macquarie Island and Hobart. Observations of total ozone and of its distribution with height are made by the Umkehr method. It is intended to establish a seventh Dobson ozone station at Alice Springs in the near future. Measurements from the ground stations are made daily.

Chemical ozone sensors of the Mast-Brewer type are flown from Aspendale fortnightly to measure the vertical distribution of ozone. The balloon borne samplings carried out from Aspendale provide vertical profiles of ozone concentrations from ground level to, approximately, 27,000 metres.

Since the inception of the ozone monitoring program results have provided no definite evidence of any change in the concentration of stratospheric ozone which can be ascribed to pollutants.

Halocarbons

Measurements have commenced of halocarbons, Freon 11 ($C Cl_3F$) and carbon tetrachloride ($C Cl_4$). Ground level concentrations of Freon 11 are monitored regularly at Aspendale and Cape Grim in Tasmania (the interim site for the Australian Baseline Station). Using aircraft sampling the Freon 11 and carbon tetrachloride content of air at 4,000 metres over Bass Strait and at 9,000 metres over the Great Australian Bight is measured regularly. These gases are also sampled using high altitude balloons.

Oxides of Nitrogen

A spectrophotometric method (Dobson spectrophotometer) is being used to establish average background levels of nitrous oxide.

One year's data from both Aspendale and Brisbane suggest that seasonal variations in nitrous oxide concentration closely parallel those for ozone. Work is underway to improve the technique and accuracy of the method used for monitoring this gas.

In the near future it is planned to start measuring nitric oxide in the stratosphere (the first such measurements for the Southern Hemisphere).

Erythemal Ultra-Violet Radiation

A network of six ground level ultra-violet monitoring stations distributed around Australia was established one year ago. However, this program is not sufficiently advanced to determine whether or not there are any systematic trends in changes in the incidence of ultra-violet radiation reaching the land surface in Australia.

Stratospheric Water Vapour

A balloon-borne infra-red radiometer is used to measure stratospheric water vapour at altitudes of 24 to 27 km. Attempts are being made to use the same balloons to obtain grab-samples of stratospheric air for laboratory measurements of CO_2, halocarbons, and oxides of nitrogen.

NASA Flight

The Divison recently availed itself of the opportunity to participate in a flight over Tasmania by the NASA laboratory aircraft "Galileo II". On the flight

techniques used in Australia to measure freons were compared, and were found to be consistent with methods used in the U.S.A. Results from the flight confirmed that freon levels in the atmosphere over Southern Australia differed little from those of the Northern Hemisphere.

Division of Cloud Physics

Particles in the Stratosphere

Studies are being made of the size, composition and concentration of particles found in the lower stratosphere. Direct measurements of these particles began with samplings from U-2 aircraft flights in 1962. From 1967 to 1974 stratospheric particles have been sampled using an impactor designed by the Division and flown on balloons launched by the U.S. Atomic Energy Commission. Since 1974 samplings have taken place bi-monthly from balloons launched by the Department of Science from its Mildura launching site. The program includes co-operative ventures with the University of Melbourne and the Max Planck Institute.

Results on the seasonal and longer-term trends in particle concentration are now becoming available.

Chemical Analysis of Particles

A technique has been developed for detecting the common atmospheric ions in particles down to a very small size. The single-particle analysis technique applies a thin film of conventional chemical reagents to particles by vacuum deposition. Exposure to water vapour promotes a reaction the products of which are viewed with an electron microscope.

(3) AUSTRALIAN FLUOROCARBON PRODUCTION AND USAGE

DEPARTMENT OF ENVIRONMENT, HOUSING AND COMMUNITY DEVELOPMENT

Following a 1975 request from the OECD for national figures on fluorocarbon production and usage, the (then) Department of Environment began to collate data from the aerosol and fluorocarbon manufacturing industries. This data base has subsequently been maintained, both to provide information for the OECD and to facilitate assessment of the industrial impacts and likely efficiency of any controls which may be proposed. Details of information forwarded to the OECD are attached.

Australia produced 14,000 tonnes of CFC's in 1974, the most recent year for which the OECD has worldwide data. It appears from information becoming available, that this will rise to some 17,000 tonnes in 1976. Although these tonnages appear large, they should be viewed in the context of an estimated annual global production of some 756,000 tonnes, the Australian production representing only 1.96 of the total. CFC's are produced at two plants in Australia, these being insignificant imports (768 tonnes) and no exports.

As will be noted from the attached OECD figures, on a "per capita" basis, Australia has a very high rate of aerosol usage, typically being the second or third highest user of most products. On this basis, it is by far the largest user of insect sprays and repellents. This factor is largely responsible for Australia's unique consumption of roughly equal percentages of fluorocarbon usage in domestic and personal products (approx. 35% total CFC production each); most other OECD countries use a far higher proportion in personal products (typically 55% personal, 15% domestic).

There has been an increasing trend for some other aerosols to be propelled by other gases, most commonly butane, which has a cost advantage. This has especially been the case for insect sprays, which present relatively few formulation problems. It is unlikely the trend will extend to personal products such as hairsprays as the product is too flammable and CFC's have good flame retardant properties.

No firm regulatory measures are being planned for the present pending the outcome of joint international studies into the dimensions of this problem, and establishment of the need for such controls.

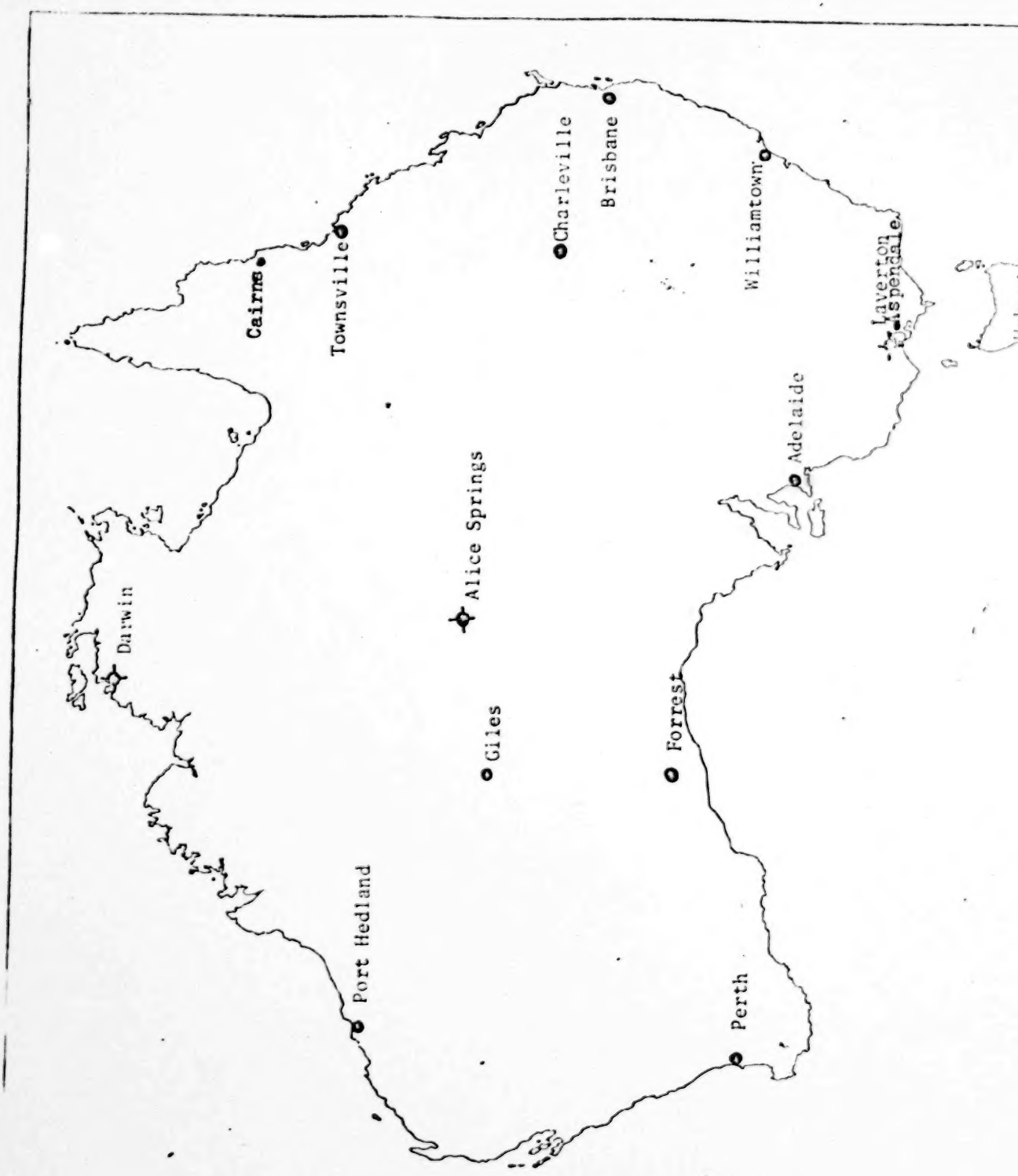
Cairns
Townsville
Charleville
Brisbane
Williamtown
Laverton
Kalgoorlie
Adelaide
Alice Springs
Darwin
Giles
Forrest
Port Hedland
Perth

TABLE III

Aerosol Use and Production[a] in Selected Countries, 1970 and 1974

1970	Total Use[b] (Units per 1000 people)	Insecticides	Paints	Household	Hair Spray	Deodorants	Production (Million Units)
Australia	NA	NA	NA	NA	NA	NA	NA
Canada	6240	330	520	1640	1450	1070	133
Finland	NA	NA	NA	NA	NA	NA	NA
France	4400	318	99	596	1690	318	277
Italy	3100	847	19	394	1050	414	173
Japan	1600	453	120	253	519	213	194
Netherlands	4400	430	78	1000	1290	650	90
Sweden	3600	253	101	406	1320	885	20
Switzerland	8200	305	168	1540	3020	1930	60
United Kingdom	5500	432	234	1470	1820	576	361
United States	13000	545	1045	2864	2230	2840	2554
1974							
Australia	9256	1834	856	2732	1637	2149	125
Canada	8020	400	620	2000	1200	1740	180
Finland	3546	375	4	750	417	2000	NA
France	NA	NA	NA	NA	NA	NA	NA
Italy	NA	NA	NA	NA	NA	NA	NA
Japan	2090	622	154	362	507	244	230
Netherlands	5808	815	41	1190	1705	1502	155
Sweden	NA	NA	NA	NA	NA	NA	NA
Switzerland	NA	NA	NA	NA	NA	NA	NA
United Kingdom	NA	NA	NA	NA	NA	NA	NA
United States	13500	660	1185	3410	2090	3360	2849

a/ All aerosol propelled units (or containers) are included; not just those using fluorocarbons as a propellant.

b/"Total" figures exceed sum of individual specialty uses since later does not cover food-related uses.

Source: Country Survey by U.S. and Canada; IMOS report, pg. 91; Chemical Specialties Manufacturers Association, Inc.

ATTACHMENT A

This attachment is a summary of replies provided in answer to two OECD questionnaires on the Australian fluorocarbon industry.

AUSTRALIAN F11 and F12 PRODUCERS

Australian Fluorine Chemicals P/L

Pacific Chemical Industries P/L

TOTAL AUSTRALIAN PRODUCTION AND USAGE (tonnes, 1970-1975)

	1970	1971	1972	1973	1974	1975 (est)
Aerosols	6,834	7,461	8,390	9,647	10,700	11,840
Refrigeration	1,370	1,714	1,927	2,216	2,000	2,700
Foam	831	907	1,020	1,173	1,300	1,410
Total	9,235	10,082	11,337	13,036	14,000	approx 16,000

Approximate total production capacity 25,000 tonnes.

ANALYSIS OF FLUOROCARBON CONTENT IN AEROSOLS, AND TOTAL USE PER 1000 POPULATION

	Total Aerosol Production (X1000)	Units Per 1000 Population	Fluorocarbon Propellant Aerosols Per 1000 Units	% Containing Fluorocarbons	% of Total Fluorocarbon Production
Insect spray	24,421	1,884	911	50	}
Household	24,536	1,893	92	5	}
Air Fresheners	11,223	866	866	100	}
Paints	11,410	880	561	70	5
Hair Spray	21,033	1,627	1,455	90	}
Other personal (deodorants, etc)	28,665	2,169	2,041	95	} 35
pharmaceutical	645	49	24	70	<1
TOTAL	126.5 million	9,296	5,617	approx 60	approx 40

AUSTRALIAN AEROSOL INDUSTRY (PRODUCTION AND DISTRIBUTION)

Volume of domestic wholesale sales	$90,000,000
" " " retail "	$126,000,000
" " imports	$ 75,000

Number employed in production and distribution of aerosols approx 3000

AUSTRALIAN REFRIGERATION INDUSTRY

Value of Manufacturers' sales	$86,878,000
Value of Exports	$13,793,000
Value of Imports	$92,422,000
Capital Employed in Refrigeration and air conditioning	$ 1,771,000
Value added	$39,552,000
Number employed	3,704